Noise Impact Assessment of a Proposed Air Conditioning System

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Executive summary

An environmental noise survey and noise impact assessment have been undertaken at 99 Fellows, London, NW3 3JS, to assess the potential increase in noise levels from the installation of an air conditioning system on the surrounding Noise Sensitive Receptors. The measured background sound levels have allowed a BS4142:2014 noise assessment to be carried out.

The BS4142:2014 assessment indicates that given the proposed plant unit, the rating sound level falls above the background sound level of the area by 20.0 dB. This is assuming the worst-case scenario when the loudest unit is installed working at its maximum capacity and its noise emissions are compared with the lowest statistical most repeated value during the quietest night. However, provided an acoustic enclosure is installed around the unit with a minimum sound reduction of 28 dB, all plant noise emissions should fall a minimum of 5 dB below the prevailing background sound level. When assessed in accordance with the NPSE this would indicate 'No observed Effect Level.

An overview of the recommendations can be found below:

Recommendations and Mitigation Measure Overview
- An enclosure capable of reducing the cumulative noise emissions of the unit by at least **25.0** dB should be installed. - All mechanical plant should be fitted on appropriate anti-vibrational mounts.

The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

1.1 Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a proposed Air Conditioning System ('the Proposed Development') at 99 Fellows, London, NW3 3JS ('the Site').

The Applicant is preparing a planning application to be submitted ('the Application') to Camden Council.

Accordingly, the following technical noise assessment has been produced to accompany the Application to the Local Authority.

This report details the existing background sound climate at the nearest receptors, as well as the sound emissions associated with the Proposed Development.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.2 Scope & Objectives

The scope of the noise assessment can be summarized as follows:

- Baseline sound monitoring survey to evaluate the prevailing sound levels at the nearest sensitive receptor ('NSR') to Site;
- Detailed sound modelling, acoustic calculation and analysis in accordance with ISO9613 – 1 prediction methodology to predict sound levels at the NSR.;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the proposed sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Practice Guidance in England and Wales, BS4142:2014 and other relevant standards.

1.3 Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

- National Planning Policy Framework (2019)
- Noise Policy Statement for England
- IEMA Guidelines on Noise Impact Assessments
- BS 4142:2014
- ISO 9613-2 Attenuation of sound during propagation outdoors

2. Site Description & Background Information

2.1 Site & Surroundings

The new mechanical air conditioning system is proposed to be mounted on the roof of the proposed site. The surrounding area is mainly comprised of residential dwellings. The closest residential dwelling is the flat right to the west and east of the proposed site. Due to its proximity to the external AC units, those flats will be considered the Noise Sensitive Receptor (NSR) in the subsequent assessment. The main noise source in the area is traffic noise from the surrouning road networks

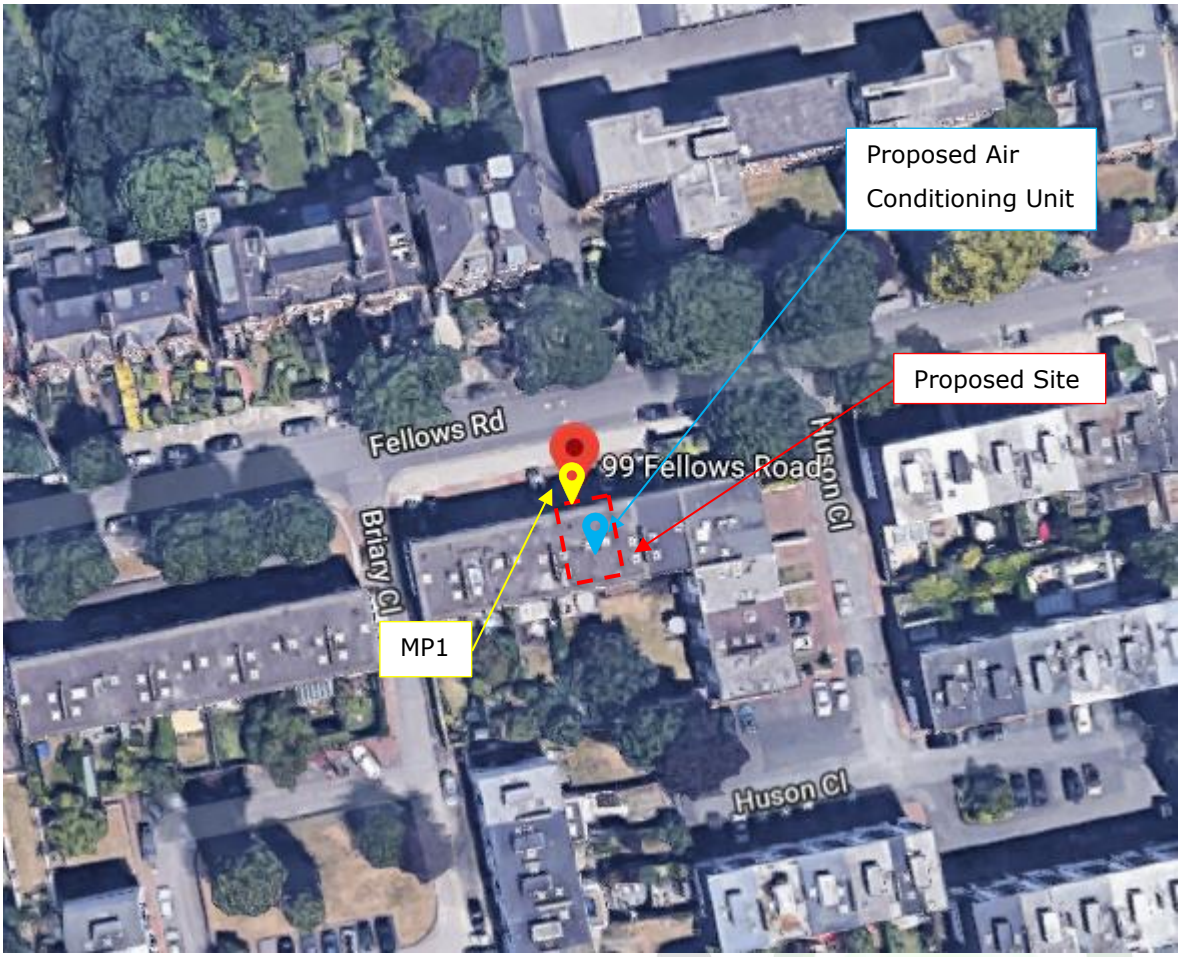


Figure 1.0 - Site and Surroundings

2.2 Background

The site is currently an existing dwelling. It is proposed that one air conditioning unit be installed at the roof of the flat. It is assumed that the plant unit could be in operation at any point during the day or night time period. Plans of the site and unit location can be found in Appendix C.

3. Environmental Noise Survey

In order to characterise the sound profile of the area at the proposed development, a long-term 72-hour environmental sound survey was carried out from the 25th of October 2019 to the 28th of October 2019.

3.1 Measurement Methodology

For the long-term sound monitoring, the sound level meter was placed at 2nd-floor level protruding from the window. The microphone was placed approximately 1m from the façade of the building. The monitoring position was chosen in order to collect representative sound levels of the area during the week and weekend day and night time periods. This position was also representative of the sound levels at the closest NSR to the proposed site.

3.2 Measurement Equipment

Piece of Equipment	Serial No	Calibration Deviation
CESVA SC420 Class 1 Sound level meter	T238953	≤0.5
CESVA CB006 Class 1 Calibrator	901013	

Table 1.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

3.3 Weather Summary

As the long-term environmental noise survey was carried out over an un-manned period no localized records of weather conditions were taken, however, during the setup and collection of the equipment the weather was calm with wind speeds less than 5m/s and no precipitation. All measurements have been compared with met office weather data for the area. When reviewing the time history of the noise measurements, any time period that was thought to be affected by the local weather conditions has been omitted. The analysis of the noise data includes statistical and percentile values which aid in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each period during the entire measurement.

Weather Conditions - 01/11/2019 – 05/11/2019 – Toolong Weather				
Time period	**Air temp (^{0}C)**	**Rainfall (mm/h)**	**Wind Speed (m/s)**	**Wind Direction**
25/10/19 – 00:00 – 23:59	7.0 – 18.8	0.0 – 15.6	1.2 – 10.6	WNW
26/10/19 – 00:00 – 23:59	8.0 – 14.9	0.0 – 6.0	0.8 – 8.9	W
27/10/19 – 00:00 – 23:59	5.6 – 15.8	0.0 – 3.0	0.0 – 5.3	SW
27/10/19 – 00:00 – 23:59	4.8 – 22.8	0.0	0.0 – 6.2	S

Table 2.0 – Meteorological Data

3.4 Results

3.4.1 Summary Results

The following table shows a summary of the sound survey results; L_{Aeq}, L_{Amax}, L_{A90} and the L_{A10} for the measurement period.

Measurement Position MP1				
Measurement Time Period ('t')	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
Day 1 – 25/10/19 – 09:15 - 23:00	60.0	100.0	54.0	63.0
Night 1 – 25/10/19 – 23:00 – 07:00	50.0	81.0	47.0	53.0
Day 2 – 26/10/19 – 07:00 – 23:00	55.0	86.0	52.0	57.0
Night 2 – 26/10/19 – 23:00 – 07:00	48.0	78.0	42.0	52.0
Day 3 – 27/10/19 – 07:00 – 23:00	56.0	92.0	48.0	55.0
Night 3 – 27/10/19 – 23:00 – 07:00	46.0	82.0	36.0	49.0
Day 4 – 28/10/19 – 07:00 – 14:30	63.0	99.0	52.0	66.0

Table 3.0 – Sound Survey Summary Results

3.4.2 Background Sound Level Summary Results

The following table shows a summary of the background sound level results during the measurement period.

Measurement Position MP1				
Measurement Period ('t')	**$L_{A90,t}$**	**Statistically most Repeated $L_{A90,t}$**	**Min. $L_{A90,t}$**	**Max. $L_{A90,t}$**
Day 1 – 25/10/19 – 09:15 - 23:00	54.0	48.0	44.0	57.0
Night 1 – 25/10/19 – 23:00 – 07:00	47.0	42.0	41.0	47.0
Day 2 – 26/10/19 – 07:00 – 23:00	46.0	46.0	39.0	50.0

Night 2 – 26/10/19 – 23:00 – 07:00	37.0	36.0	35.0	40.0
Day 3 – 27/10/19 – 07:00 – 23:00	40.0	41.0	37.0	43.0
Night 3 – 27/10/19 – 23:00 – 07:00	36.0	32.0	30.0	40.0
Day 4 – 28/10/19 – 07:00 – 14:30	46.0	41.0	38.0	51.0

Table 4.0 – Background Sound Level Summary Results

3.5 Subjective impression & Context

While site visit, the subjective impression of the engineer was that the sound profile of the area was dominated by traffic noise from Fellows Road and its surrounding network.

3.6 Uncertainty

BS4142:2014 section 10.0 states that uncertainty in the calculation of sound levels during the assessment process can arise from both the measured values and calculation methods.

To ensure the accuracy of the assessment consideration has been taken for the level of uncertainty in the measured data and associated calculations in the proposed methodology used to undertake the assessment. Where the level of uncertainty could affect the conclusion, reasonably practicable steps have been taken to minimise the level of uncertainty. Where the level of uncertainty is excessive, additional measurements and site visits have been conducted to increase the confidence in the results. In all instances the following steps have been taken to address the uncertainty;

1) Measured Values; A detailed understanding of the source of noise under investigation has been conducted including consideration for the complexity, variability over time and location, the character and effect of the residual sound level in comparison with the source, the measurement location, quantity of measurements and distance/intervening ground conditions, measurement time interval and the range of times measurement were taken, the suitability of weather conditions, the level of rounding and the classification of the instrumentation used to conduct the assessment.
2) Calculation Methods; Consideration has been taken for the accuracy of the measured sound levels, the character of the sound emissions in question, the calculation method and the simplification of the real situation to "fit" the modelled situation. Recognised standards and validated methods and processes have been used to establish accurate values during the calculation process.

For the avoidance of doubt, the level of uncertainty will not be quantified. If appropriate consideration is taken for points 1 and 2 during the collection of data and analysis thereof, then the influence of uncertainty in the final result is at its lowest practical value.

4. Noise Assessment

4.1 BS4142:2014 Noise Assessment

The following section of the report analyses the expected impact of the noise emissions associated with the installation of the plant unit.

4.1.1 Specific Sound Level

The plant unit has not been chosen yet, however, the client has provided to NOVA Acoustics Ltd a list with the three potential units. The loudest plant has been assessed in order to assess the worst-case scenario.

The A-weighted sound power levels associated with the proposed development, based on manufacturers and vendor data, and the expected sound pressure level at the NSR, calculated as Lp = Lw – 10 log (Q/4πr²)**,** can be seen in the following table. The closest NSR is the roof lights placed at the roofs lights of the adjacent dwellings, which are a minimum of 6m away from the proposed location of the plant unit.

Make	Model	Sound Power (dBA)	Sound Pressure (dBA) at the NSR
Daikin	RXYSCQ4TV1	68.0	44.0
Daikin	5MXM90N	64.0	40.0
Mitsubishi	PUMY-SP140YKM	74.0	50.0

Table 5.0 - Specific Sound Level Summary

As can be seen in the table above, Mitsubishi PUMY-SP140YKM is the loudest of the presented units and, therefore it will be used in the subsequent assessment.

4.1.2 Rating Level

Rating Penalty

Section 9 of BS4142:2014 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142:2014 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method."

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142:2014 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."

d) Intermittency

BS4142:2014 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time … if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."

Rating Penalty Assessment

Considering the requirements of the rating penalty, an assessment of the sound source associated with the Proposed Development, in terms of whether any rating penalties are applicable, and has been detailed in the following table.

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
1	+2	--	--	--	Possible tonal and component audible at the NSR

Table 6.0 – Rating Penalty Assessment

Rating Level

Incorporating the rating penalties with the specific sound levels, the rating sound levels have been derived and have been detailed in the following table.

NSR	Rating Sound Level (dB)
1	52.0

Table 7.0 – Summary of Rating Sound Levels

4.1.3 Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

To provide a robust and conservative assessment the table below outlines a summary of the lowest statistically most repeated background sound level value for the night time period. As it is assumed that the plant associated with the development could operate at any point during the day or night.

Measurement Period ('t')	$L_{A90,t}$	Statistical $L_{A90,t}$	Min. $L_{A90,t}$	Max. $L_{A90,t}$
Night 3 – 27/10/19 – 23:00 – 07:00	36.0	32.0	30.0	40.0

Table 8.0 – Summary of Background Sound Levels

Discussion:

According to the statistical analysis in the lowest most repeated $L_{A90,t}$ value during the measurement time period is 32.0 dBA. As can be seen the range of $L_{A90,t}$ during the measurement period is relatively low and the statistically most repeated $L_{A90,t}$ sits on the bottom of the range, thus the statistical value is deemed to be 'typical' and will be used in the subsequent assessment.

4.1.4 BS4142 Assessment

The rating sound level has been assessed in accordance with BS4142:2014 at the closest NSR. The BS4142:2014 assessment at the NSR, during operation hours can be seen in the table below.

Results	Sound Level (dB)	Notes
Rating Sound Level	52.0	As shown in Table 8.0
Measurement Period Background Sound Level	32.0	As shown in Table 9.0

Excess of Rating over Background Sound Level	+20.0	Assessment Indicates a 'Significant Adverse Impact, depending on the context'.

Table 9.0 – BS4142:2014 Assessment

Discussion

The assessment above indicates that given the loudest proposed plant unit (Mitsubishi PUMY-SP140YKM), the rating sound level falls above the background sound level of the area by 20.0 dB assuming the worst-case scenario when the loudest unit is installed, it is working at its maximum capacity and its noise emissions are compared with the lowest statistical most repeated value during the quietest night. The rating sound level would fall 14.0 and 10.0 dB if Daikin RXYSCQ4TV1 or 5MXM90N were installed respectively. Therefore, the impact is expected to be reduced. However, in order to ensure the noise emissions from the proposed plant units do not cause an adverse impact, it is advised that all plant noise emissions fall a minimum of 5dB below the prevailing background sound level. Consequently, a further 25 dB of attenuation is required.

4.1.5 Recommendations & Mitigation

The following section outlines the mitigation measures that are necessary to reduce the impact of Proposed Development.

- An enclosure capable of reducing the cumulative noise emissions of the unit by at least 25.0 dB should be installed if the loudest unit is required.
- If the Daikin RXYSCQ4TV1 is installed an enclosure capable of reducing the cumulative noise emissions of the unit by at least 19.0 dB should be installed.
- If the Daikin 5MXM90N is installed an enclosure capable of reducing the cumulative noise emissions of the unit by at least 15.0 dB should be installed.
- All mechanical plant should be fitted on appropriate anti-vibrational mounts.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the

time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms.

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

National Planning Policy Framework (2019)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2019. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 170e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 180 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) *Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
b) *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
c) *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

Noise Policy Statement for England

Paragraph 180 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life;*
- *Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

IEMA Guidelines on Noise Impact Assessments

The IEMA Guidelines for Environmental Noise Assessment address the key principles of noise impact assessment and are applicable to all development proposals where noise effects may occur. The guidelines set out key principles for noise impact assessment relevant to all types of project regardless of size. The guidance provides advice with regards to the collection of baseline noise data, prediction of noise levels and how noise should be assessed. The guidance recognizes that the effect associated with a noise impact will be dependent on a number of factors including but not limited to the sensitivity of the receptor, frequency and duration of the noise source and time of day. The Guidelines accept that a simple change in noise levels using a single noise indicator may fail to adequately reveal the actual noise impact of the proposal. The character of the noise must be considered and the Guidelines suggest comparing several noise indicators such as the LAeq, LAmax and LA90 as a more rigorous approach.

Absolute levels such as those set out in WHO Guidelines are also considered and the Guidelines suggest that a change in noise levels in an area where the existing levels are above WHO Guidelines

should be considered as having more of an adverse effect than a change in noise levels in an area where existing levels are well below.

The Guidelines stop short of providing specific assessment criteria which developments should achieve but instead suggests that the methodology adopted should be selected on a site by site basis regarding relevant national and local standards.

The Guidelines contain effect descriptors for changes in noise levels and for noise effect levels. These are summarized below:

Effect Descriptors	
Very substantial	Greater than 10 dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise
Substantial	Greater than 5 dB L_{Aeq} change in sound level at a noise sensitive receptor, or a 5 to 9.9 dB LAeq change in sound level at a receptor of great sensitivity to noise
Moderate	A 3 to 4.9 dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5dB LAeq change in sound level at a receptor of some sensitivity
Slight	A 3 to 4.9 dB L_{Aeq} change in sound level at a receptor of some sensitivity
None/Not Significant	Less than 2.9 dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals

Table 10.0 – IEMA Guidelines effect descriptors

Noise Effect Level		
Time	**Lowest Observed Adverse Effect Level**	**Significant Observed Adverse Effect Level**
07:00 - 23:00	50 dB $L_{Aeq,16\ hour}$	60 dB $L_{Aeq,16\ hour}$
23:00 - 07:00	40 dB $L_{Aeq,8\ hour}$	55 dB $L_{Aeq,8\ hour}$
	60 dB L_{AFMax} (at the facade)	80 dB L_{AFMax} (at the facade)

Table 11.0 – IEMA Guidelines noise effect level

The Guidelines are not prescriptive as to how a noise impact assessment should be carried out and allow assessors to consider factors such as frequency spectra, days and times of operation, frequency of operation and any other factor which allows the noise to be assessed in context.

BS 4142:2014

BS4142:2014 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

BS4142:2014 states: "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

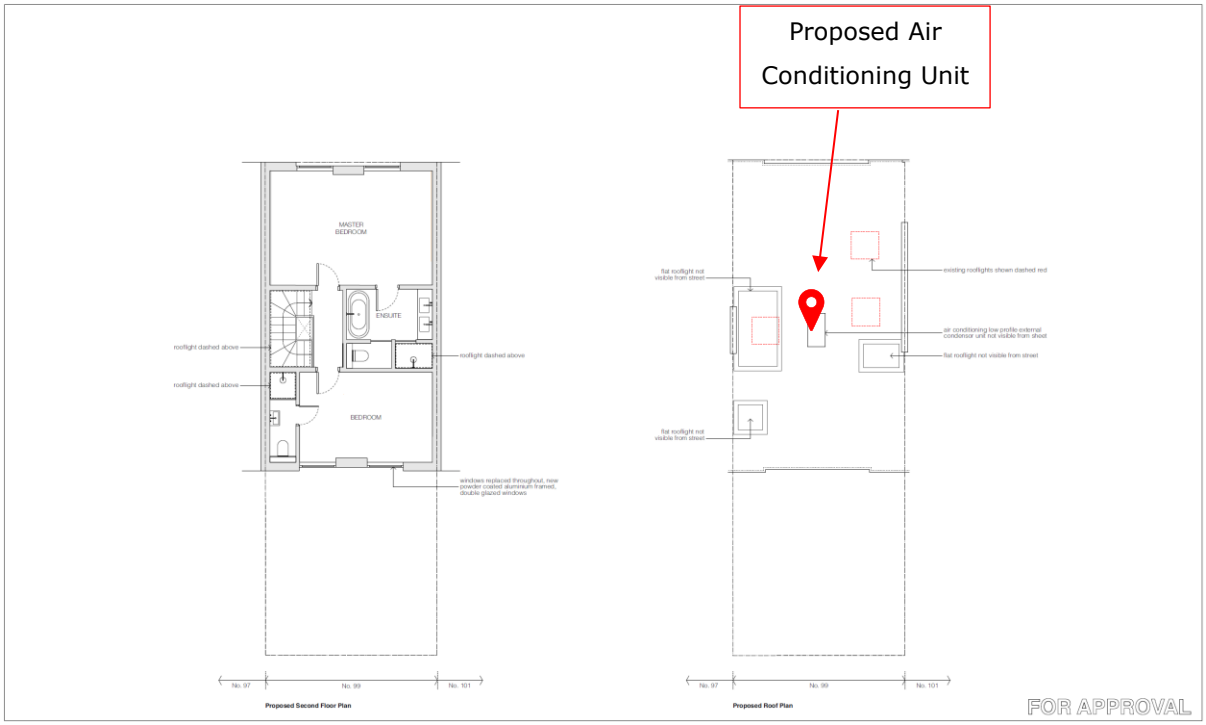
- "Typically, the greater this difference, the greater the magnitude of the impact."
- "A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."
- "A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."
- "The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact, depending on the context."

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

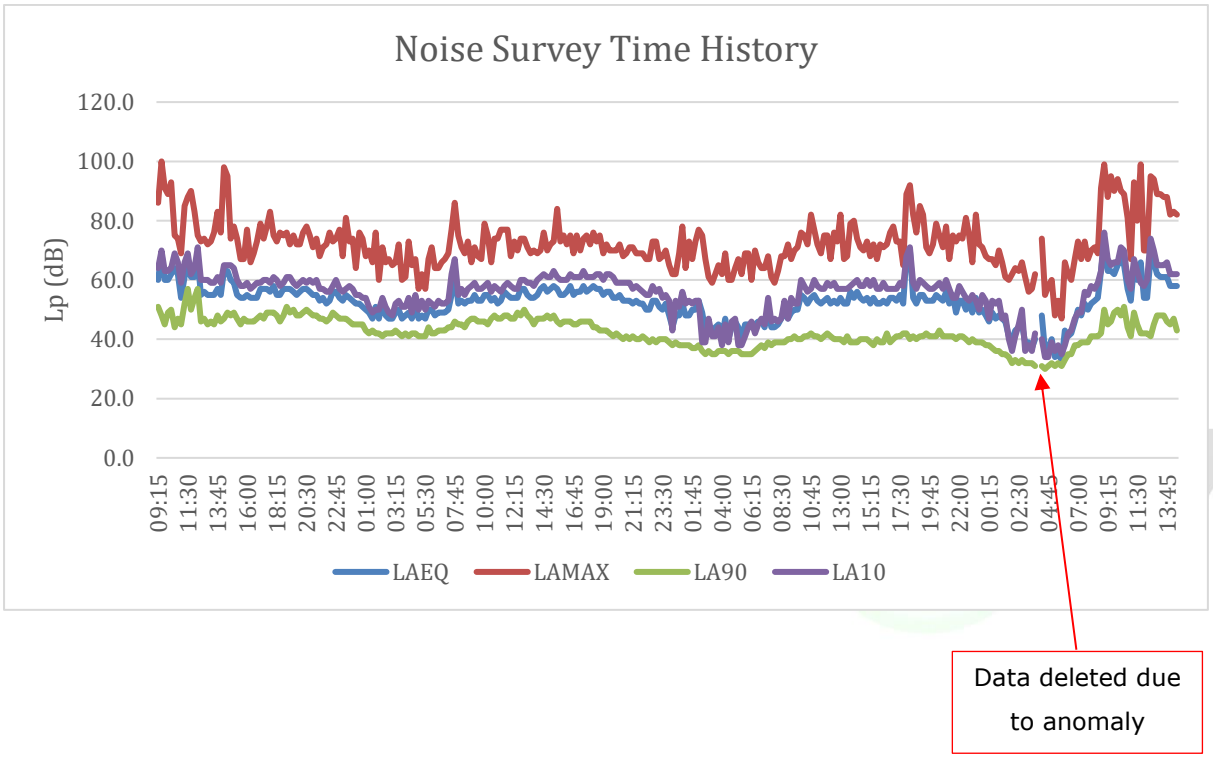
- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating sound level does not exceed the background sound level, this is an indication of the specific sound source having a negligible impact and would therefore classified as a No Observed Adverse Effect Level.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

Appendix C - Site Plan



Appendix D - Environmental Sound Survey



Appendix E – Manufacturer's Data Sheet

PUMY-SP OUTDOOR UNITS		PUMY-SP112VKM	PUMY-SP112YKM	PUMY-SP125VKM	PUMY-SP125YKM	PUMY-SP140VKM	PUMY-SP140YKM
NUMBER OF CONNECTABLE INDOOR UNITS	Branch box / Mixed*1	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10
CAPACITY (kW)	Heating (nominal)	14.0	14.0	16.0	16.0	16.5	16.5
	Cooling (nominal)	12.5	12.5	14.0	14.0	15.5	15.5
	Heating (UK)	13.9	13.9	15.8	15.8	16.3	16.3
	Cooling (UK)	10.0	10.0	11.2	11.2	12.4	12.4
COP / EER (NOMINAL)		4.42 / 4.03	4.42 / 4.03	4.10 / 3.65	4.10 / 3.65	4.10 / 3.30	4.10 / 3.30
SCOP / SEER		-	-	-	-	-	-
MAX AIRFLOW (m³/min)	Heating / Cooling	77	77	83	83	83	83
SOUND PRESSURE LEVEL (dBA)		52	52	53	53	54	54
SOUND POWER LEVEL (dBA)	Cooling	72	72	73	73	74	74
DIMENSIONS (mm)	Width x Depth x Height	1050 x 330+40 x 981	1050 x 330+40 x 981	1050 x 330+40 x 981	1050 x 330+40 x 981	1050 x 330+40 x 981	1050 x 330+40 x 981
WEIGHT (kg)		93	94	93	94	93	94
ELECTRICAL SUPPLY		220-240v, 50Hz	380-415v, 50Hz	220-240v, 50Hz	380-415v, 50Hz	220-240v, 50Hz	380-415v, 50Hz
PHASE		Single	Three	Single	Three	Single	Three
POWER INPUT (kW)	Heating/Cooling (nominal)	3.17 / 3.10	3.17 / 3.10	3.90 / 3.84	3.90 / 3.84	4.02 / 4.70	4.02 / 4.70
	Heating/Cooling (UK)	4.18 / 1.61	4.18 / 1.61	5.15 / 2.00	5.15 / 2.00	5.31 / 2.44	5.31 / 2.44
STARTING CURRENT (A)		14	7	14	7	14	7
RUNNING CURRENT (A)	Heating/Cooling [MAX]	13.48 / 13.18 [30.5]	4.82 / 4.71 [13.0]	16.58 / 16.33 [30.5]	5.93 / 5.83 [13.0]	17.09 / 19.98 [30.5	6.11 / 7.14 [13.0]
FUSE RATING (BS88) – HRC (A)		1 x 32	1 x 16	1 x 32	1 x 16	1 x 32	1 x 16
PIPE SIZE MM (in)	Gas	15.88 (5/8")	15.88 (5/8")	15.88 (5/8")	15.88 (5/8")	15.88 (5/8")	15.88 (5/8")
	Liquid	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")	9.52 (3/8")
TOTAL PIPING LENGTH (m)	Branch box / Mixed*1	120	120	120	120	120	120
FURTHEST PIPING LENGTH (m)	(With no branch boxes)	80 (70)	80 (70)	80 (70)	80 (70)	80 (70)	80 (70)
BETWEEN BRANCH BOX AND OUTDOOR UNIT - LENGTH (m)		55	55	55	55	55	55
BETWEEN BRANCH BOX AND INDOOR UNIT - LENGTH (m)		25	25	25	25	25	25
BETWEEN INDOOR AND OUTDOOR UNIT - HEIGHT (m)		50m max*2	50m max*2	50m max*2	50m max*2	50m max*2	50m max*2
BETWEEN INDOOR AND INDOOR UNITS - HEIGHT (m)	Branch box / Mixed*1	12	12	12	12	12	12
CHARGE REFRIGERANT (kg) / CO_2 EQUIVALENT (t) - R410A (GWP 2088)		3.5 / 7.31	3.5 / 7.31	3.5 / 7.31	3.5 / 7.31	3.5 / 7.31	3.5 / 7.31
MAX ADDITIONAL REFRIGERANT (kg) / CO_2 EQUIVALENT (t) - R410A (GWP 2088)		9.0 / 18.79	9.0 / 18.79	9.0 / 18.79	9.0 / 18.79	9.0 / 18.79	9.0 / 18.79

Notes: *1 **Branch box** - only using branch boxes (PAC-MK) on the system. **Mixed** - using a mix of branch boxes (PAC-MK) and City Multi indoor units on the same system. *2 40m max if outdoor installed below. 0m if mixed system.
*3 SCOP / SEER available separately in the 'City Multi VRF Seasonal Efficiency' document. Based on Ecodesign Lot 6 to EN14825 standard.

RXYSCQ-TV1

VRV IV S-series compact heat pump

VRV IV S-series

Variable Refrigerant Temperature

The most compact VRV

- Compact & lightweight single fan design makes the unit almost unnoticeable
- Covers all thermal needs of a building via a single point of contact: accurate temperature control, ventilation, air handling units and Biddle air curtains
- Wide range of indoor units: either connect VRV or stylish indoor units such as Daikin Emura, Nexura
- Incorporates VRV IV standards & technologies: Variable Refrigerant Temperature and full inverter compressors
- 3 steps in night quiet mode: step 1: 47 dBA, step 2: 44 dBA, step 3: 41 dBA
- Possibility to limit peak power consumption between 30 and 80%, for example during periods with high power demand
- Contains all standard VRV features

RXYSCQ-TV1

CONNECTABLE INDOOR UNITS	Wall mounted												Floor standing						Flexi type				Round flow cassette			Fully flat cassette				Concealed ceiling								Ceiling suspended		
	FTXG-L				CTXS-K		FTXS-K					FTXS-G	FVXG-K			FVXS-F			FLXS-B(9)				FCQG-F			FFQ-C				FDXS-F(9)				FDBQ-B /FBQ-D				FHQ-C		
	20	25	35	50	15	35	20	25	35	42	50	60	71	25	35	50	25	35	50	25	35	50	60	35	50	60	25	35	50	60	25	35	50	60	25	35	50	60	35	50	60
RXYSCQ-TV1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Outdoor Units				RXYSCQ4TV1	RXYSCQ5TV1
Capacity	Nominal Cooling	kW		12.1	14
	Nominal Heating	kW		12.1	14
Power Input 50Hz	Cooling	kW		3.43	4.26
	Heating	kW		3.18	3.91
EER				3.53	3.29
COP				3.81	3.58
Dimensions	Height x Width x Depth	mm		823 x 940 x 460	
Weight		kg		94	94
Refrigerant Circuit	Refrigerant Type			R410A	
Sound Pressure (Nom)	Cooling	dBA		51	52
Sound Power (Nom)	Cooling	dBA		68	69
Maximum No of Connectable Units				8	10
Electrical Details	Power Supply	Phase / Hz / V		1 / 50 / 230	
	Running Current	amps		19.0	
	Starting Current	amps		4	
	Fuse Rating	amps		32	
Piping Limits	Total Piping length	m		300	
	Maximum Length	m		70 (90 equivalent)	
	Maximum Vertical Rise	m		30	
Piping Connections	Liquid	inch (mm)		3/8 (9.5)	3/8 (9.5)
	Gas	inch (mm)		5/8 (15.9)	5/8 (15.9)
Capacity Index Limit				50~130	62.5~162.5

Outdoor Unit			5MXM90N
Capacity	Nominal Cooling	kW	9,0
	Nominal Heating	kW	10,4
Dimensions Height x Width x Depth		mm	734 x 958 x 340
Weight		kg	68
Electrical Details	Power Supply	Phase	1ph
		Hz	50
		V	220-240
	Running Current	amps	Refer to Multi Combination Tables
	Starting Current	amps	11,8
	Fuse Rating	amps	30
Refrigerant Circuit	Refrigerant Type		R32
	Refrigerant Charge	kg	2,40
Sound Pressure (Cooling) Nom		dBA	52
Sound Power (Cooling)			64
Piping Limits	Max. Length (OU- IU)	m	25
	Max. Level Difference (IU- IU) m		7,5
	Max. Level Difference (IU- OU) m		15
	Total piping length (Actual)	m	75
Piping Connections	Liquid	inches (mm)	5x 1/4 (6.4)
	Gas	inches (mm)	2x 3.8 (9.5)
			1x 1/2 (12.7)
			2x 5/8 (15.9)
Operating range (Cooling) Min / Max		°CDB	-10 / 46
Operating range (Cooling) Min / Max		°CWB	-15 / 18
Number of Connected Indoor Units			5
Air Flow Rate (Cooling) Nom		m^3/sec	0,818